Whooping Crane Likelihood of Occurrence Report

Wilton IV Wind Energy Center

Burleigh County, North Dakota

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EXECUTIVE SUMMARY

The likelihood of whooping cranes occurring in the Wilton IV Wind Energy Center (Project) is low. There is a lower proportion of suitable wetland habitat within the Project Area than the surrounding area. There were no recorded historical observations of whooping cranes within the proposed Project Area. A total of 89 observations occurred within the 35-mile buffer area around the Project Area.

The Wilton IV Wind Energy Center will be developed abutting the eastern boundary of three existing NextEra wind energy projects: Wilton I, Wilton II, and Baldwin Wind Energy Centers (together, the Cumulative Area). To address the overall cumulative impacts of these projects on whooping cranes, NextEra completed an additional likelihood of occurrence analysis for the combined areas of all four projects (Cumulative Area).

For the proposed and existing Wilton I-IV projects (Cumulative Area), the likelihood of whooping crane in the cumulative area is low. There is a lower proportion of suitable wetland habitat within the Cumulative Area than the surrounding area. There were no recorded historical observation of whooping cranes documented within the Cumulative Area and 98 observations within 35 miles of the Cumulative Area. The whooping crane observations should be used for general inference regarding use of an area and cannot be used for micrositing features away from whooping crane sightings because some of the observations may lack accurate locations. Additionally, the absence of a sighting in a specific area should not be construed as a whooping crane having never occurred in that area. Overall, the Cumulative Area falls within the migration corridor, making it likely that whooping cranes will travel through the area. The area surrounding the Cumulative Area contains proportionally more wetlands, which suggests that cranes traveling within the migration corridor may find the Cumulative Area less attractive than the surrounding landscape.

The two most likely impacts of wind development on whooping cranes are: 1) direct mortality of whooping cranes due to collisions with transmission lines, turbines, or other facilities; or 2) avoidance of the area around the facility by whooping cranes. Each project site is unique with respect to the relationship of the facilities with potential whooping crane habitat.

The results of this report will be integrated into a Bird and Bat Conservation Strategy, Biological Assessment, and Environmental Impact Statement for the Wilton IV Wind Energy Center.

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1.0 INTRODUCTION

Wilton Wind IV, LLC (Wilton IV), a wholly owned subsidiary of NextEra Energy Resources (NextEra), is proposing to develop the Wilton IV Wind Energy Center (Project) in Burleigh County, North Dakota (Figure 1). The Project Area boundary used in this report is dated August 12, 2014. One concern when developing wind energy facilities in parts of the Great Plains is the federally endangered whooping crane (*Grus americana*). The remaining wild population of whooping cranes migrates through portions of Great Plains during the spring and fall between their wintering range at the Aransas National Wildlife Refuge in Calhoun County, Texas and Wood Buffalo National Park in the Canadian Providences of Alberta and Northwest Territories. Whooping cranes have been killed by collisions with power lines, and the whooping crane recovery plan lists construction of power lines, fences, and other structures in the migration corridor as a threat to the species (Canadian Wildlife Service [CWS] and United States Fish and Wildlife Service [USFWS] 2007). Thus, the construction and operation of wind turbines may pose a risk to whooping cranes through direct mortality or avoidance of areas where turbines are located.

As part of the tiered approach to evaluating potential adverse to species of concern and their habitats as recommended in the voluntary U.S. Fish and Wildlife Service (USFWS) Land-Based Wind Energy Guidelines (USFWS 2012), NextEra contracted Tetra Tech, Inc. (Tetra Tech) to conduct a landscape-scale analysis to assess the potential occurrence of whooping cranes at the Project. The same methods were also applied to the combined project areas of Wilton I, Wilton II, Baldwin, and the Project area (Wilton IV) as an overall (Cumulative Area) evaluation of the Wilton projects. The objective of this likelihood of occurrence analysis is to evaluate the biological and landscape features within the Project Area to determine the potential for whooping cranes to occur. Despite the small population size of whooping cranes, certain landscape features may increase the likelihood of whooping crane occurrence during migration. Thus, Tetra Tech developed a likelihood index to evaluate the Project Area based on its location in the migration corridor, the presence of feeding and roosting sites, and the availability of habitat within the Project Area compared to the surrounding landscape. The likelihood index does not predict how many whooping cranes will occur in any given Project Area; rather, it scores a project site based on a suite of variables that are related to whooping crane occurrence. Higher scores denote higher potential likelihood of occurrence. This assessment tool is not intended to replace field surveys. However, given the low probability of detecting a whooping crane during field surveys which minimizes the utility of surveys to document presence or absence from a given area, this assessment tool was designed to take advantage of available data.

The results of this report will be integrated into a Bird and Bat Conservation Strategy, Biological Assessment, and Environmental Impact Statement for the Wilton IV Wind Energy Center.

2.0 LEGAL STATUS OF THE WHOOPING CRANE IN THE UNITED STATES

The whooping crane is protected by both federal and state laws in the United States. It was considered endangered in the United States in 1970 and the endangered listing was 'grandfathered' into the Endangered Species Act (ESA) of 1973, which prohibits "take" (CWS and USFWS 2007). "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. §1532(19)). "Incidental take" occurs when a take of an ESA-listed species occurs as an unintended consequence of an otherwise legal activity, as would the case in the unlikely event of a fatality occurring at a wind farm. To Tetra Tech's knowledge, no whooping crane fatality has occurred at a wind energy facility. There are at least 46 known fatalities or serious injuries associated with collision with transmission lines (Stehn and Wassenich 2008).

The whooping crane is also considered a level III Species of Conservation Priority by the North Dakota Game and Fish Department (Hagen et al. 2005). Under the North Dakota comprehensive wildlife conservation strategy guide, a level III species of conservation priority is a species of moderate priority but are believed to be peripheral or non-breeding in North Dakota (Hagen et al. 2005).

The whooping crane population in North America has experienced sharp declines and disappearance from most of its historic range (CWS and USFWS 2007). The number of whooping cranes in North America prior to 1870 is estimated to have been between 500 and 1,400 individuals (Allen 1952; Banks 1978), but some biologists suggest that the population may have numbered as many as 10,000 individuals (CWS and USFWS 2007). Activities such as habitat destruction, hunting, and displacement due to anthropogenic activities likely lead to widespread population declines (CWS and USFWS 2007). One self-sustaining wild population of whooping cranes currently exists in the world. Members of this population breed primarily within the boundaries of Wood Buffalo National Park in Canada and migrate through the central United States in route to the wintering grounds at Aransas National Wildlife Refuge along the Gulf Coast of Texas. This flock is referred to as the Aransas-Wood Buffalo National Park Population. Due to intensive management, this population has increased from 15 birds in 1941 to 304 birds as of the 2013/2014 winter whooping crane survey conducted by USFWS (WCCA 2014).

3.0 ENVIRONMENTAL SETTING AND PROJECT AREA DESCRIPTION

3.1 Environmental Setting

The Project Area is located within the Northwestern Glaciated Plains Ecoregion (Bryce et al. 1996). This semi-arid region of North Dakota includes level to rolling plains topography with isolated sandstone buttes or badlands formations. Historically, much of the landscape was a mix of western mixed-grass prairie and short-grass prairie of western wheatgrass (*Agropyron smithii*), big bluestem (*Andropogon gerardii*), needle-and-thread grass (*Stipa comata*), and green needlegrass (*Stipa viridula*), with associated prairie pothole type wetlands (Bryce et al. 1996). Today, most native grasslands have been largely replaced by row-crop agriculture and cattle grazing pastures in level areas. Remnant native grasslands may still persist in areas of steep or broken topography.

The region contains numerous small wetlands that vary from shallow vegetated depressions, fens, and intermittent creeks. Agriculture in Burleigh County consists predominantly of dry-land farming of alfalfa, sunflowers, corn, and soybeans and is interspersed with cattle grazing pastures.

3.2 Project Area Description

The Project Area is 24,374 acres (approximately 38 square miles) of privately owned lands and is located approximately 18 miles north of Bismarck in Burleigh County. The Project Area includes a 0 proposed interconnection transmission line from Wilton IV running east to west from the Wilton IV Project Area through the operating Wilton II and Wilton I wind energy centers. The Project Area habitat is characteristic of the region with mostly agriculture lands (winter wheat, milo, and pastures/hayfields for nearby cattle feed lots). The Project Area has numerous open water sources consisting mostly of kettle ponds in lowland areas. Few structures occupy the Project Area, including a few farm residences and ranches. The Canfield Lake National Wildlife Refuge (NWR) is located 1.8 miles from the Project Area. There is also a waterfowl production area (WPA) near the Project Area.

4.0 WHOOPING CRANE BIOLOGY

The whooping crane is a long-lived species that may reach 28 years old in the wild (Binkley and Miller 1983, USGS 2014). Individuals reach sexual maturity at 3 to 5 years of age and form life-long breeding pairs while on the wintering grounds or during spring migration (Stehn 1997; CWS and USFWS 2007). Whooping cranes have low annual reproductive output. Females typically lay 2 eggs, but only 10 percent of families arrive on the winter grounds with 2 chicks because the smaller chick usually dies within the first two weeks after hatching (CWS and USFWS 2007). The juveniles become independent of the parents on the wintering ground prior to spring migration. Sexually immature individuals (i.e., sub-adults) return to the breeding grounds where they may remain solitary or congregate in small groups on the periphery of breeding pairs (CWS and USFWS 2007).

4.1 Reasons for the Population Decline

Populations of long-lived species with low annual reproductive output such as the whooping crane are sensitive to changes in adult survival (Stahl and Oli 2006). Hunting, especially during spring migration, from 1870 to 1930 resulted in 274 documented whooping crane fatalities (Allen 1952). In addition, Hahn (1963) tallied 309 mounts and 9 skeletons in museum collections throughout the world. It is possible that mortality from shooting exceeded annual production of juveniles during the early 1900s (CWS and USFWS 2007).

Degradation and loss of breeding habitat extirpated the whooping crane from much of its core breeding range in North America. Whooping cranes once bred from the southern edge of Lake Michigan north through southern Minnesota to northeastern North Dakota through Manitoba, Saskatchewan, and Alberta (Allen 1952). Conversion of prairie ecosystems to agriculture and ranching made much of the breeding habitat unsuitable (CWS and USFWS 2007). Due to their high degree of site fidelity, members of the Aransas-Wood Buffalo Population are unlikely to naturally recolonize the historic whooping crane range in North America.

4.2 Threats to Whooping Cranes

Several factors threaten the whooping crane because of its small population size and concentration of all members of the Aransas-Wood Buffalo National Park population at breeding and wintering locations. Threats to the whooping crane identified in the recovery plan that are related to wind power development include collision with power lines, fences, and other structures, and loss and degradation of stop-over and wintering habitat (CWS and USFWS 2007; USFWS 2009).

Power lines pose a major threat to whooping cranes when they are located in the vicinity of foraging or roosting habitat because individuals often fly at low altitudes (33 to 49 feet above the ground) when moving among sites (CWS and USFWS 2007; Stehn and Wassenich 2008). The majority of documented fatalities during migration are due to collision with power lines. Since 1956, 46 whooping cranes have been killed or seriously injured as a result of collisions with power lines (Stehn and Wassenich 2008). Collisions with power lines have resulted in fatalities of whooping cranes in other experimental populations that are maintained by the introduction of captive-reared young. Fourteen individuals from the Florida non-migratory population and 1 individual in the migratory Wisconsin population have died from colliding with power lines.

Although whooping crane mortality has not been attributed to wind turbines, the whooping crane recovery plan considers wind power development within the whooping crane migration corridor a threat because of the construction of power lines and associated structures (CWS and USFWS 2007). Nagy et al. (2012) showed that the cranes flew around the turbines; therefore, minimizing the likelihood of turbine collision. However, the USFWS (2009) holds the opinion that whooping cranes will avoid stopping at areas with operational wind turbines. Thus, behavioral avoidance of wind farms by whooping cranes may reduce the probability of collision, but may amount to loss of stop-over habitat.

5.0 WHOOPING CRANE MIGRATION

Whooping cranes undertake a 5,000-mile round-trip migration from the breeding area in Canada to the wintering area in Texas every year. Individuals depart the breeding ground in Canada and travel south through Alberta, Canada, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and reach the wintering ground on the Texas coast. The migration route is well defined and 94 percent of all observations occur within a 200-mile wide corridor during spring and fall migration (CWS and USFWS 2007; Figure 2). Whooping cranes may occasionally travel with sandhill cranes during migration, and stop-over sites used by sandhill cranes may indicate potential whooping crane stop-over areas (CWS and USFWS 2007).

During migration, whooping cranes can occur where suitable habitat is available. Some sites in the migration corridor are used consistently and have high annual use. Four traditional stop-over sites are found in Nebraska (Platte River), Kansas (Cheyenne Bottoms Wildlife Management Area, Quivira National Wildlife Refuge), and Oklahoma (Salt Plains National Wildlife Refuge). These sites are designated as critical habitat under the Endangered Species Act (CWS and USFWS 2007).

5.1 Fall Migration

Whooping cranes depart the breeding grounds at Wood Buffalo National Park in mid-September and parents with young are usually the last to depart. Birds may travel alone, in pairs, in family groups, or in small flocks (Johns 1992). Individuals travel southeast about 300 miles to the major staging area in Saskatchewan, where they may remain for 2 to 4 weeks before resuming migration. During fall migration, birds may stay at traditional stop-over sites for 7 to 10 days, but stays as long as 6 weeks have been documented at Quivira National Wildlife Refuge (CWS and USFWS 2007). The majority of whooping cranes reach the wintering grounds by mid-November. In North Dakota most sightings occur from early October to early November; peak migration occurs around October 18 (Austin and Richert 2001).

5.2 Spring Migration

Whooping cranes depart the wintering ground at Aransas National Wildlife Refuge in late March; the last birds depart in May. Breeding pairs are typically first to depart and migration is facilitated by winds from the southeast. There is no known staging area in spring as there is in fall, and migration is completed in 2 to 4 weeks. Traditional stop-over sites that are used in fall are also used in spring. However, individuals spend fewer days at stop-over sites during spring migration. Whooping cranes travel through North Dakota from early April to late April; peak migration occurs around April 19 (Austin and Richert 2001).

5.3 Migration Flight Behavior

Whooping cranes are diurnal migrants and primarily fly by using static soaring, but low-level flapping flight may be used when conditions dictate. Migration is initiated after the air has warmed and thermal updrafts are present. Individuals spiral upwards on thermals of warm air to heights of 1,000 to 6,000 feet (Kyut 1992), then enter into long, descending glides. This process is repeated throughout the day until suitable habitat is reached. Static soaring is energy efficient as birds seldom flap after they are airborne. Whooping cranes may travel up to 500 miles per day in ideal conditions; during average conditions they may travel 250 miles per day (Stehn and Wassenich 2008). During the end of the migration flight, individuals will enter long descending glides and use flapping flight at lower altitudes until they reach suitable roosting and feeding habitat. Whooping cranes do not regularly migrate during unfavorable weather conditions such as a strong headwind, rain or other precipitation, or overcast conditions. When visibility is poor, individuals use flapping flight at lower altitudes until they reach suitable roosting or feeding habitat.

5.4 Stop-over Habitat Characteristics

Whooping cranes require roosting habitat when they stop during migration. They often select sites with unobstructed visibility (Austin and Richert 2001). Palustrine wetlands (freshwater wetlands characterized by emergent vegetation) are used most often used as roosting sites, but individuals have been found roosting at lacustrine wetlands (wetlands around a lake), and riverine wetlands (wetlands along a river). Size of wetlands used during spring and fall migration ranges from 0.4 hectare (ha) to over 500 ha, and no seasonal use patterns are evident (Austin and Richert 2001); 75 percent of recorded roost wetlands were smaller than 4 ha (10 acres).

Although size of the wetlands used for roosting varies, water depth ranges 18 to 20 inches and little variability is found among sites.

Whooping cranes will forage in both wetlands and agricultural fields during migration and may commute between roosting and feeding areas. Palustrine wetlands are used most often when whooping cranes forage in wetlands, but lacustrine and riverine have also been used as feeding sites (Austin and Richert 2001). Among agricultural crops used as feeding sites, use of winter wheat was higher than other crop types in fall and use of row-crop stubble (comprised mostly of corn) was higher in spring than other crop types (Austin and Richert 2001). Whooping cranes have also been observed feeding in the remaining stubble of harvested sorghum, sunflower, and soybean fields (Austin and Richert 2001). Feeding sites are often found adjacent to roosting sites. For example, 94.9 and 72.9 percent of roosting sites were within 0.62 mile of feeding sites in spring and fall, respectively (Johns et al. 1997, USFWS 2009).

6.0 ASSESSMENT OF WHOOPING CRANE LIKELIHOOD OF OCCURENCE

The primary threats of wind energy development to whooping cranes are mortality due to collision with transmission lines and associated structures and the loss of habitat. Because of the high levels of concern regarding whooping cranes, the ability to evaluate the risk to whooping cranes at defined particular project area is a critical component to understanding the environmental impacts of a proposed wind project. Here, Tetra Tech presents a method used to evaluate the likelihood of whooping cranes to occur at the Wilton IV Project Area located in central North Dakota. The same methods were also applied to the combined project areas of Wilton I, Wilton II, Baldwin, and the Project area (Wilton IV) as an evaluation of all the Wilton projects, referred to as the Cumulative Area (see Section 8). This evaluation method incorporates the location of the Project area in the migration corridor, the presences of feeding and roosting sites, and the availability of habitat within the Project Area compared to the surrounding landscape (Table 1). Tetra Tech expects whooping cranes to be more likely to occur over the life of a project at projects with high scores. For the purposes of this report, the scores calculated for each parameter were totaled and the likelihood of occurrence for whooping cranes in the Project Area was ranked accordingly: Low (0-4); Moderate (5-10); High (10+). This assessment tool is not intended to replace field surveys. However, given the low probability of detecting a whooping crane during field surveys thereby minimizing their utility to document presence or absence from a given area, this assessment tool was designed to take advantage of available data.

Table 1 Parameters used in the likelihood index calculation.

Parameter	Score	Justification
Location in the Migration Corridor (L)		
Within the 75-percent buffer	7.5	75% of all whooping crane observations occur within the 75-percent buffer
Between the 75-percent and 95-percent buffers	2.0	20% of all observations occur between 75-percent and 95-percent buffers
Outside the 95-percent buffer	0.5	5% of observations occurred outside the 95-percent buffer
Attractiveness on the Landscape (A)		
Ratio of wetlands per total acreage for the Project Area / wetland per total acreage for 35-mile area not including the Project Area	Actual ratio	Indicates if the Project Area is similar (=), less (<), or more (>) attractive than the surrounding landscape to migrating cranes searching for roosting habitat
Presence of Foraging and Roosting Habitat (W)		
Proportion of the Project Area that is a wetland-agricultural matrix	Actual Proportion	Indicates the proportion of the Project Area that is favored by cranes for foraging and roosting habitat

6.1 Location of the Project Area in the Migration Corridor (L_i)

6.1.1 Biological Justification

The location of a wind project can influence the likelihood of whooping crane occurrence due to the well-defined migratory pattern of the cranes. The median location of all crane observations was statistically derived and was used to describe the migration route from the breeding grounds to the wintering grounds (CWS and USFWS 2007). Buffers were then calculated based on isopleths of the percentage of observations (CWS and USFWS 2007; Figure 2). For example, 75 percent of all observations occurred within the 75-percent buffer. If two sites are compared, whooping cranes are more likely to stop over at a site within the 75-percent buffer than at a site outside the 95-percent buffer.

6.1.2 Scoring

Tetra Tech developed scores for the location of the Project Area based on the percent of observations within each buffer. If the Project Area location fell within the 75-percent buffer, it was scored 7.5. If the Project Area location fell between the 75-percent and 95-percent buffers, it was scored 2.0 because 20 percent of all observations occur between these buffers. If the Project Area fell outside of the 95-percent buffer, it was scored 0.5 because 5 percent of all observations occur outside the 95-percent buffer.

6.1.3 Assumptions

- The likelihood of whooping crane occurrence in the future will not deviate from the patterns observed through 2010 which is the most current available data.
- If a portion of the Project Area fell on the boundary of a buffer or in two buffers, the Project Area was assumed to be within the buffer closer to the middle of the migratory corridor.

6.2 Attractiveness on the Landscape (A_i)

6.2.1 Biological Justification

Wetlands are used by whooping cranes for feeding and roosting and the amount of wetlands within a given area compared to the surrounding landscape may influence whooping crane use of a site during migration. After whooping cranes have descended from migration flight altitudes, they may travel up to 35 miles in search of suitable roosting habitat (USFWS 2008). Therefore, Tetra Tech determined if the Project Area contained a higher proportion of wetlands than was found within the 35-mile radius surrounding the Project Area to determine the attractiveness of the Project Area compared to the surrounding area.

6.2.2 Scoring

Tetra Tech used National Wetlands Inventory (NWI) data (USFWS 2013) and National Land Cover Database data (NLCD; Homer et al. 2007) to determine the total acreage of wetlands within a Project Area and within 35 miles of the Project Area. The use of multiple data sources helps reduce the effect of limitations of any one data source (e.g., Stahlecker 1992). Tetra Tech then calculated the proportion of the total acreage of the Project Area that was comprised of wetlands and the proportion of the total acreage of a 35-mile area around the Project Area boundary that was wetlands (excluding the Project Area). Tetra Tech divided the proportion of the Project Area that was wetlands by the proportion of the 35-mile buffer that was wetlands to determine if the Project Area contained more wetlands than the surrounding area. Tetra Tech used the ratio as the score in the likelihood index equation. If the ratio was greater than 1.0, the Project Area contained more wetlands and is considered more attractive than the surrounding 35-mile buffer. If the ratio was equal to 1.0, the Project Area contained a similar proportion of wetlands and is as attractive as the surrounding 35-mile buffer. If the ratio was less than 1.0, the Project Area contained less wetlands and is less attractive than the surrounding 35-mile buffer.

6.2.3 Assumptions

- The distribution of wetlands in the Geographic Information System (GIS) data is an accurate representation of the location of wetlands in the Project Area.
- 35-miles is an appropriate scale to examine whooping crane habitat use.

6.3 Presence of Foraging and Roosting Sites (W_i)

6.3.1 Biological Justification

Whooping cranes often make low altitude flights between roosting and foraging habitat and are thus at risk of collision with power lines and other structures (CWS and USFWS 2007; Stehn and Wassenich 2008; USFWS 2009). Austin and Richert (2001) found that agricultural crops, especially corn, sorghum, and winter wheat were the habitat most often contiguous to roosting areas and that most cranes traveled 0.62 miles from a roosting site to a foraging site. Therefore, wetlands located within 0.62 mile of agricultural crops form a wetland-habitat matrix that is often used by whooping cranes during migration (Austin and Richert 2001). Tetra Tech determined the proportion of the Project Area that was comprised of wetland-agricultural matrix. This matrix included water bodies of any type (hereafter wetlands) but restricted the analysis to wetlands greater than 1 acre to eliminate inclusion of unusable wetland (e.g., borrow pits). Tetra Tech limited the analysis to crop agriculture because it is most often used for foraging habitat. Crop agriculture was restricted to agriculture greater than 1 acre in the analysis because most observations of cranes occurred in agriculture greater than 1.0 acre (Austin and Richert 2001).

6.3.2 Scoring

To quantify the amount of roosting and foraging habitat in the Project Area, geographic information system (GIS) land cover data (GAP data) was obtained for the appropriate state (i.e. North Dakota). The GIS analysis was designed to calculate the total area of wetland-agricultural matrix, which may include other habitat types between patches of wetlands and agriculture. Thus, based on the size restrictions and spatial configuration, the total acres of wetland-agricultural matrix could be greater or less than the sum of the acres of wetland and agriculture. Tetra Tech calculated the proportion of the Project Area that was wetland-agricultural matrix by dividing the total acres of wetland-agricultural matrix by the total acres of the Project Area. Tetra Tech used the proportion as the score in the likelihood index; therefore, scores may range from 0 to 1.

6.3.3 Assumptions

- The optimal distance of foraging habitat from roosting habitat is 0.62 mile.
- Habitats not classified as wetlands or agriculture are of neutral value and do not influence the availability of wetlands or agriculture on the landscape.

6.4 Likelihood Index Formula (LI_i)

The likelihood index of whooping cranes occurring in the Project Area was calculated by evaluating the landscape features in and around the Project Area. Tetra Tech used the following formula to calculate the likelihood index (LI_i):

$$LI_i = (L_i \times A_i) + W_i$$

Where L_i is the score of the Project Area location in relation to the migration corridor, A_i is the attractiveness score, or the ratio of wetlands in the Project Area to the wetlands in the 35-mile area around the Project Area, and W_i is the wetland-agricultural matrix score. The equation places the most weight on the Project Area location in the migration corridor because of the wide range of scores. Thus, if the Project Area is within the 75-percent corridor, the likelihood index will tend to score higher than if the Project Area is within the 95-percent corridor unless the attractiveness score for the Project Area within the 75-percent corridor is low (e.g., less than 0.50) or the attractiveness score for the Project Area within the 95-percent corridor is high (e.g., greater than 0.75), when the other values are equal. If the Project Area is located outside of the 95-percent corridor, the likelihood index will tend to score low because the location score is less than 1.0, unless the attractiveness score is high.

7.0 ASSESSMENT AND SUMMARY OF THE WILTON IV WIND ENERGY CENTER EXPANSION

For the Wilton IV Wind Energy Center (i.e. Project Area), the Likelihood Index Score (LI_i) is 2.81, implying a low likelihood of occurrence for the Project Area (Table 2). Thirty-three percent of the Project Area consists of suitable wetland-agriculture matrix habitat, making the Presence of Feeding and Roosting Sites (W_i) value 0.33 (Table 2 and Figure 4). The Project Area is located inside of the 75% isopleth of the migration corridor; therefore, the Location (L_i) parameter value is 7.5 (Figure 3). The proportion of available wetlands within the Project Area is lower than the surrounding 35-mile buffer area, with a calculated Attractiveness on the Landscape (A_i) value of 0.33. There were no recorded historical observations of whooping cranes within the Project Area and 89 observations within 35 miles of the proposed Project Area (see Appendix; Figure 4). The historical whooping crane observations should be used for general inference regarding use of an area and cannot be used for micrositing features away from whooping crane sightings because some of the observations may lack accurate locations. Additionally, the absence of a sighting in a specific area should not be construed as a whooping crane having never occurred in that area. Overall, the Project falls within the migration corridor, making it likely that whooping cranes will travel through the area. The area surrounding the Project contains proportionally more wetlands than the Project Area indicating that cranes traveling within the migration corridor may find the Project Area less attractive than the surrounding landscape.

Table 2 Likelihood index scores for the Wilton IV Wind Energy Center.

Location in the Migration Corridor (L_i)	Attractiveness on the Landscape (A_i)	Presence of Foraging and Roosting Habitat (W_i)	Likelihood Index Score (LI_i)*
7.5	0.33	0.33	2.81 (**Low**)

* Low (0-4); Moderate (5-10); High (10+)

8.0 ASSESSMENT OF THE CUMULATIVE WILTON I – IV WIND RESOURCE AREA (CUMULATIVE AREA)

The Wilton IV Wind Energy Center will be developed abutting to the east of three operating NextEra wind energy projects: Wilton I, Wilton II, and Baldwin Wind Energy Centers. As a result, 44,496 acres (approximately 69 square miles) of land would be developed into wind energy (Cumulative Area). To date, separate whooping crane likelihood of occurrence reports were completed for Wilton II and Baldwin Wind Energy Centers with both indicating a low likelihood of occurrence. To address the overall cumulative impacts of these projects on whooping cranes, an additional likelihood of occurrence analysis was completed combining the areas of the three operating wind energy centers and the Wilton IV Project Area (Cumulative Area). The objective of this likelihood of occurrence analysis is to evaluate the biological and landscape features within the Cumulative Area to determine the potential for whooping cranes to occur.

For the Cumulative Area, the Likelihood Index Score (LI_i) was 2.07, implying a low likelihood of occurrence (Table 3). Forty-two percent of the Cumulative Area consists of suitable wetland-agriculture matrix habitat, making the Presence of Feeding and Roosting Sites (W_i) value 0.42

(Table 3 and Figure 5). The Cumulative Area is located inside of the migration corridor; therefore, the Location (L_i) parameter value was 7.5. The proportion of available wetlands within the Cumulative Area is lower than the surrounding 35-mile buffer area, with a calculated Attractiveness on the Landscape (A_i) value of 0.22. There were no recorded historical observations of whooping cranes documented within the cumulative area and 105 observations within 35 miles of the Cumulative Area (Figure 5). The whooping crane observations should be used for general inference regarding use of an area and cannot be used for micrositing features away from whooping crane sightings because some of the observations may lack precise locations. Additionally, the absence of a sighting in a specific area should not be construed as a whooping crane having never occurred in that area. Overall, the Cumulative Area falls within the migration corridor, making it likely that whooping cranes will travel through the Cumulative Area. The area surrounding the Cumulative Area contains proportionally more wetlands indicating that cranes traveling within the migration corridor may find the Cumulative Area less attractive than the surrounding landscape.

Table 3 Likelihood index scores for the Cumulative Area of the proposed and existing Wilton projects.

Location in the Migration Corridor (L_i)	Attractiveness on the Landscape (A_i)	Presence of Foraging and Roosting Habitat (W_i)	Likelihood Index Score (LI_i)*
7.5	0.22	0.42	2.07 (**Low**)

* Low (0-4); Moderate (5-10); High (10+)

9.0 RECOMMENDATIONS

The results of this report will be incorporated into a Bird and Bat Conservation Strategy, Biological Assessment, and Environmental Impact Statement for the Wilton IV Wind Energy Center.

Risk to whooping cranes inside the migration corridor can be minimized by selecting sites that are not as attractive as the surrounding landscape. Although any wetland of suitable size may be utilized by whooping cranes, areas that contain a high proportion of wetland-agricultural matrix habitat should be considered more desirable to whooping cranes when selecting sites. Conducting a broad scale analysis of the risks associated with whooping cranes using a potential area is the first step to determining potential impacts from development.

Each wind energy project is unique with respect to the relationship of the facilities with potential whooping crane habitat. Thus, avoidance and minimization strategies are site-specific and require detailed knowledge of the project area and surrounding landscape as well as coordination with state and federal wildlife biologists.

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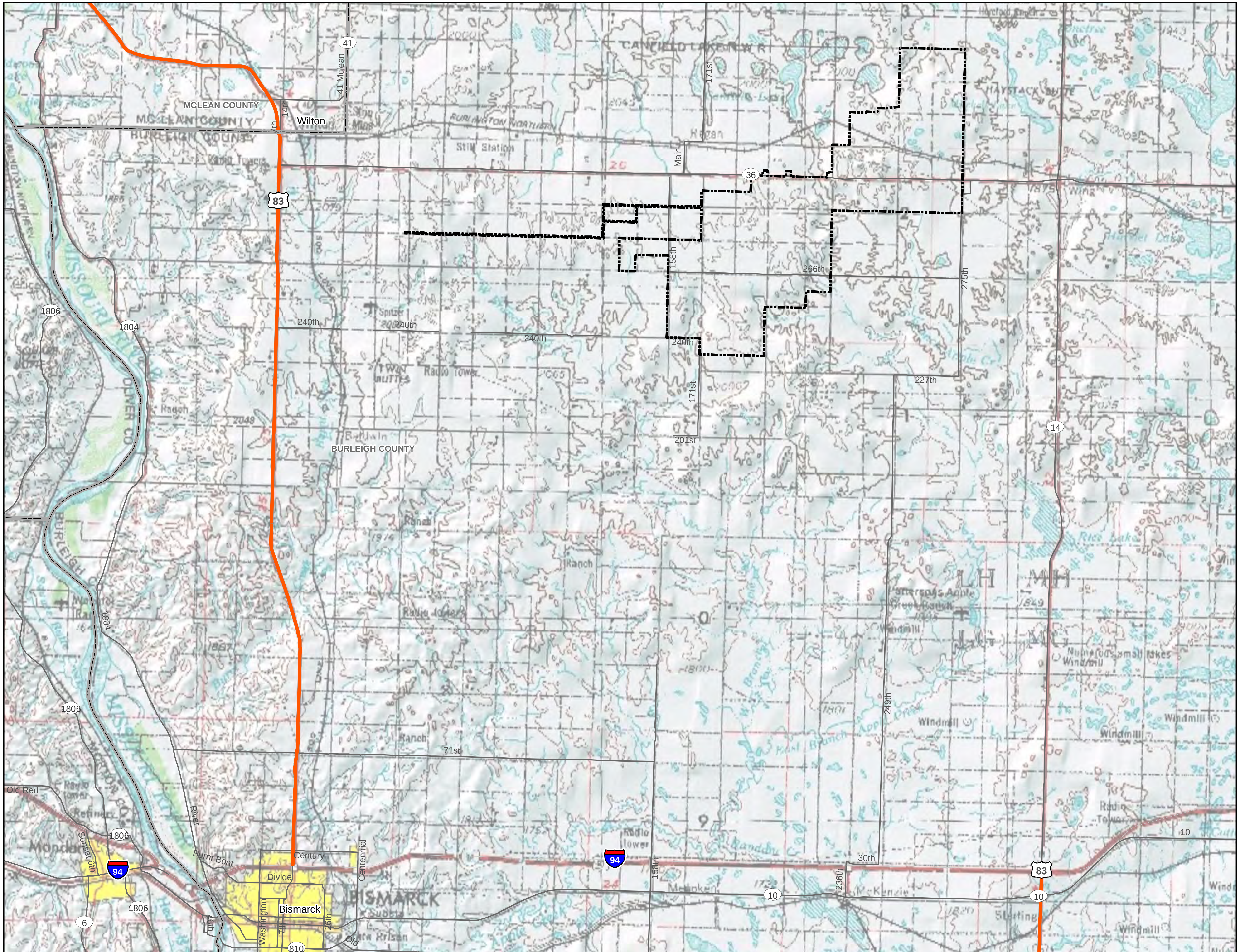


Figure 1.
Wilton IV
Wind Energy Center
Vicinity Map

Burleigh County
North Dakota

August 2014

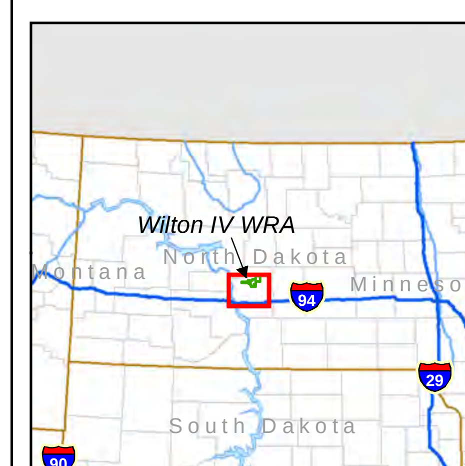
Wilton IV Project Area
County Boundary
State Boundary
Highway
Major Road
Local Road

Data Sources:
USGS Topo Quads
ESRI Streetmap 10.1

N

0 1 2 3 4
Miles

LOCATION MAP



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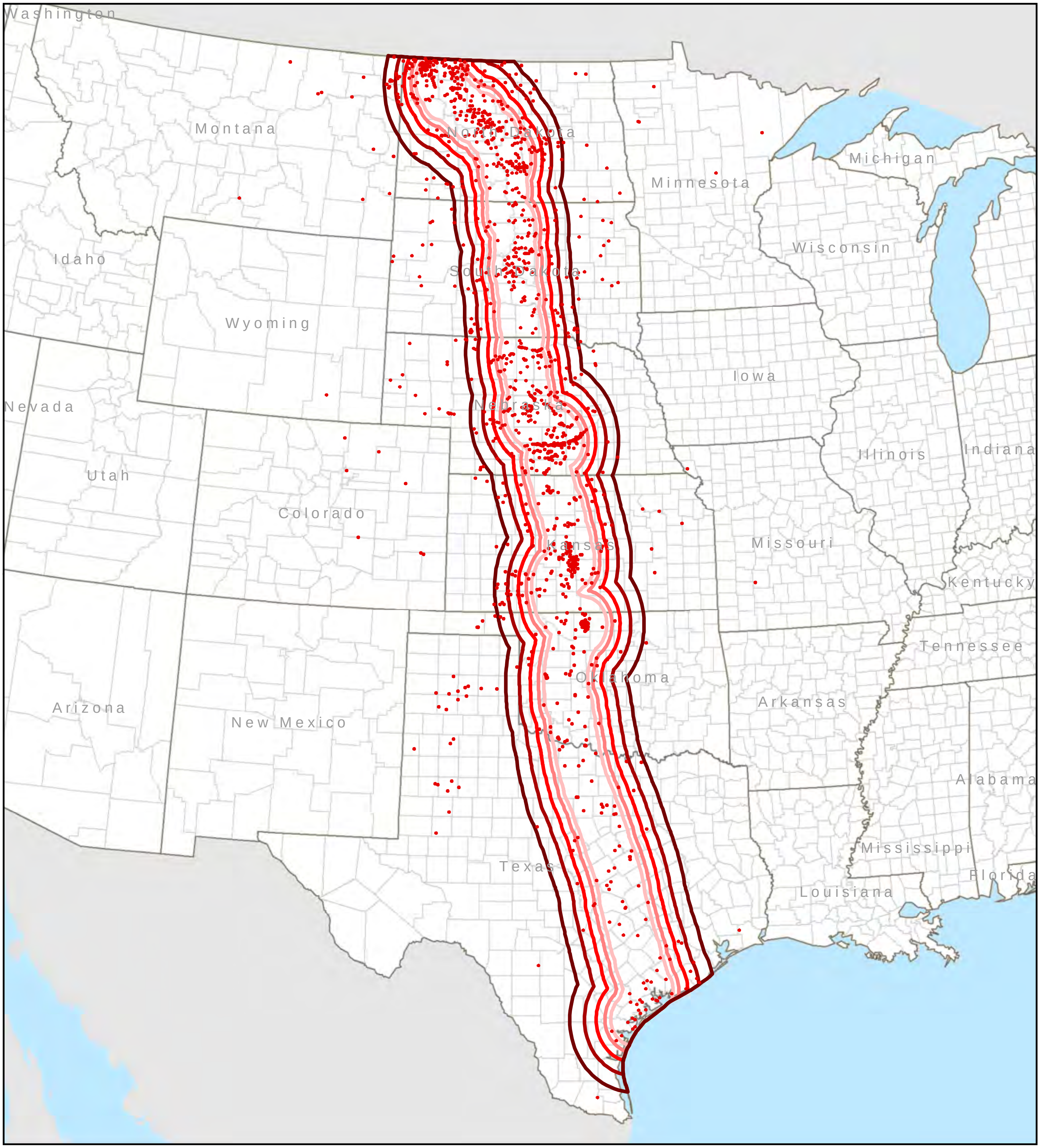

Whooping Crane Sighting

Percentage of Sightings
- 75%
- 80%
- 85%
- 90%
- 95%

State Boundary

County Boundary

N

0 75 150 225 300
Miles

Data Sources:
USFWS Whooping Crane Data
ESRI Streetmap 10.1

Figure 2.
Wilton IV
Wind Energy Center
Whooping Crane Migration
Corridor

August 2014

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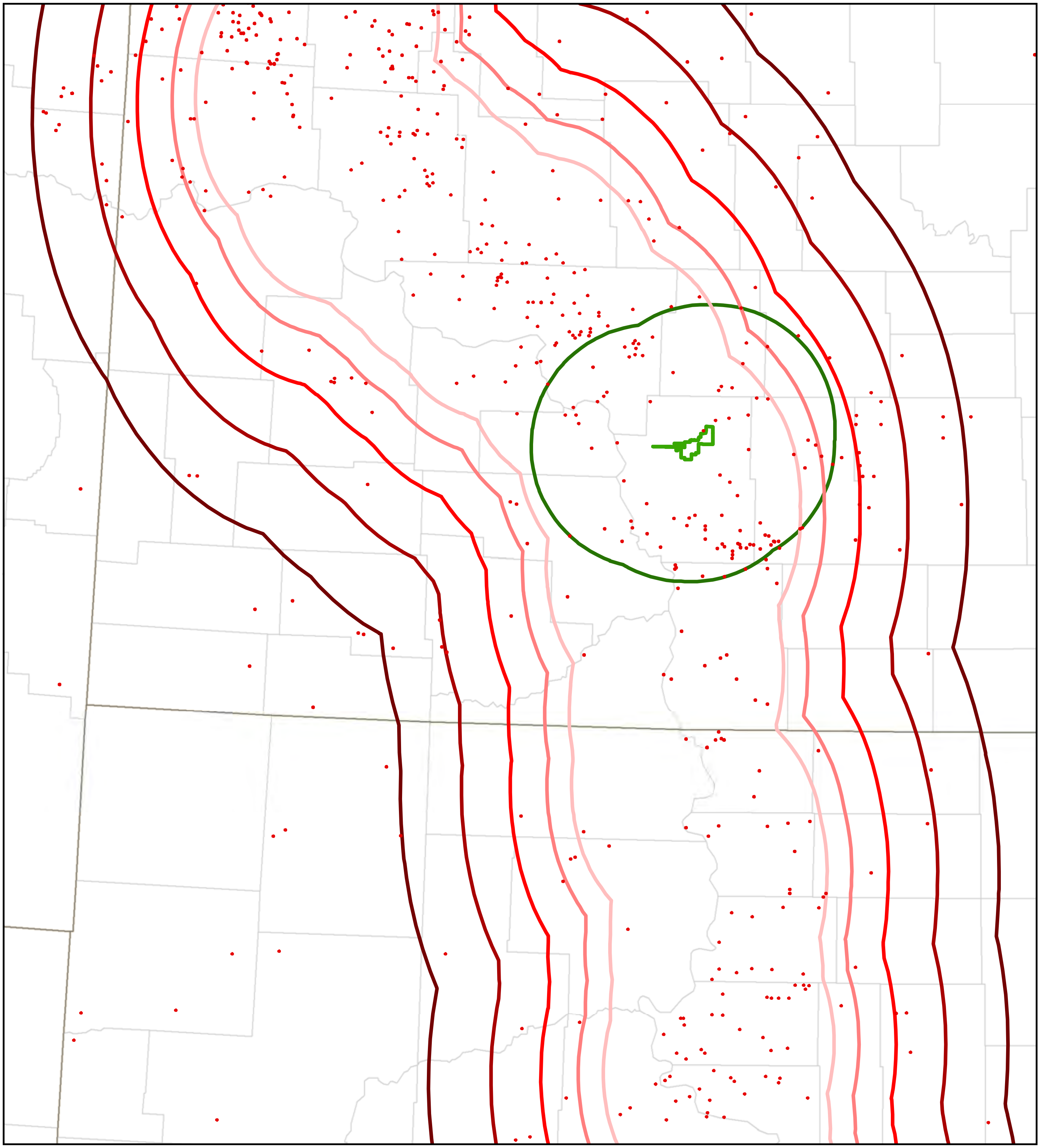

Historic Whooping Crane Sighting

Percentage of Sightings

75%

80%

85%

90%

95%

Wilton IV Project Area

35-Mile Buffer

County Boundary

State Boundary

N

0 20 40 60

Miles

Data Sources:
USFWS Whooping Crane Data
ESRI Streetmap 9.3

Figure 3.
Wilton IV
Wind Energy Center
Whooping Crane Migration
Map: North Dakota

August 2014

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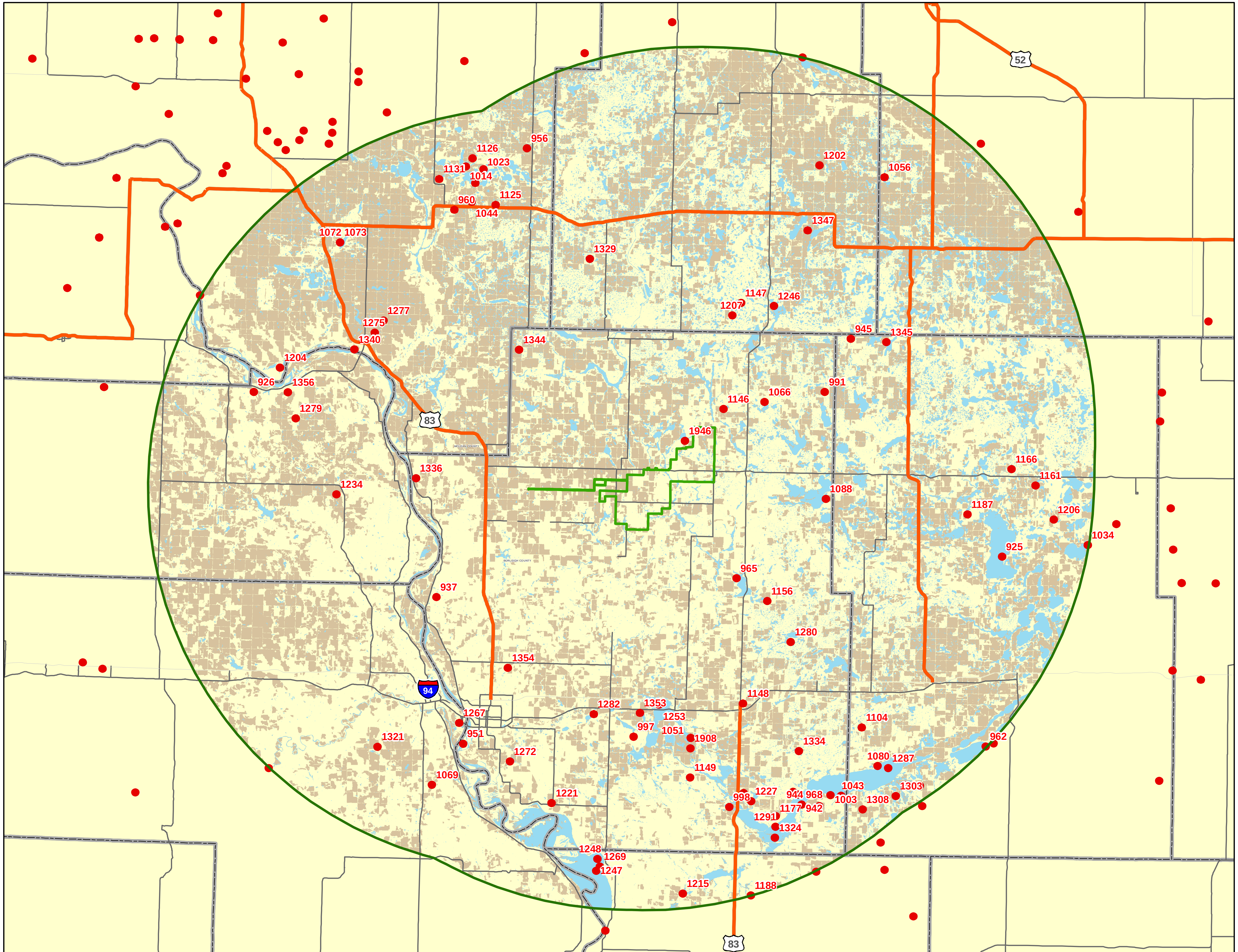

Figure 4.
Wilton IV
Wind Energy Center
Whooping Crane Habitat Map

Burleigh County
North Dakota

August 2014

Wilton IV Project Area
35-Mile Buffer
Historical Whooping Crane Sighting
Wetland
Wetland/Agricultural Matrix
Highway
Major Road
Local Road
County Boundary
State Boundary

Data Sources:
USGS Topo Quads
ESRI Streetmap 9.3

N

0 5 10 15
Miles

LOCATION MAP

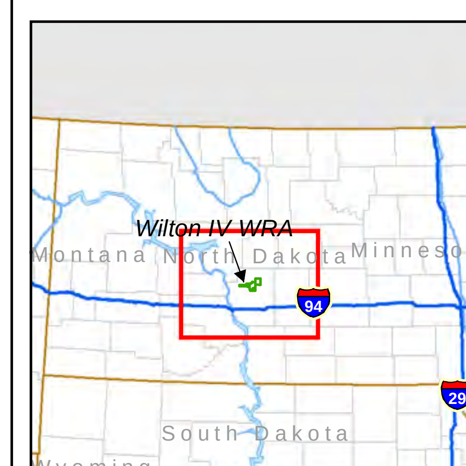

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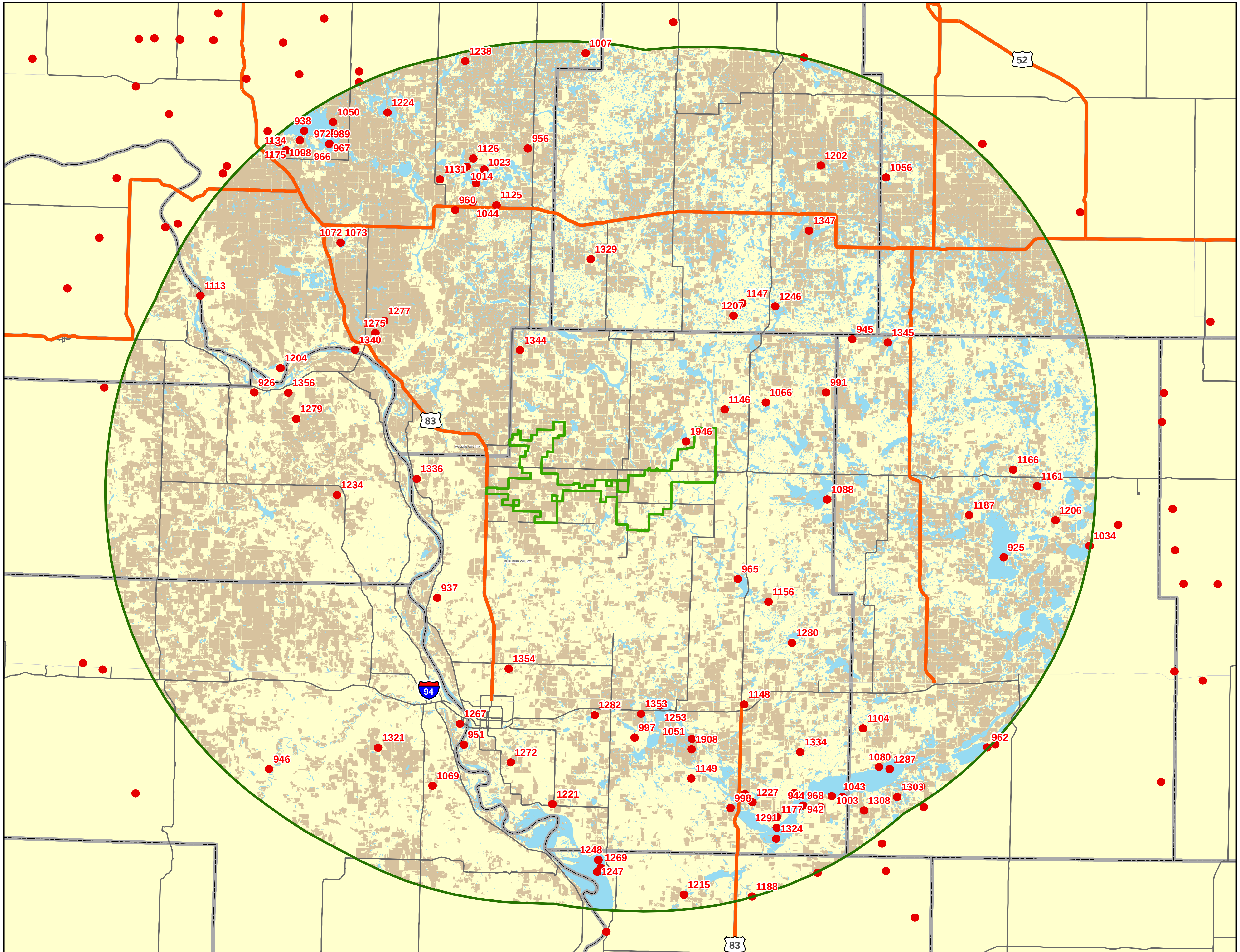
Figure 5.
Wilton I-IV Cumulative Area Whooping Crane Habitat Map

Burleigh County
North Dakota

August 2014



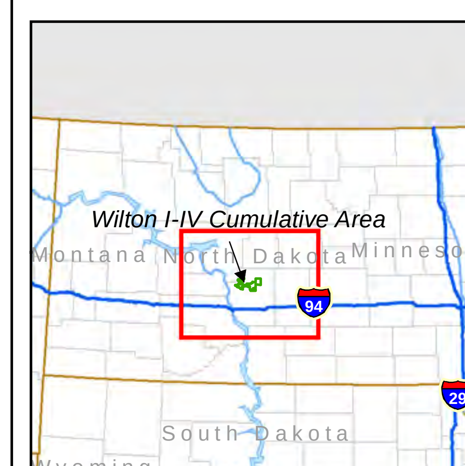
Wilton I-IV Cumulative Area
35-Mile Buffer
Historical Whooping Crane Sighting
Wetland
Wetland/Agricultural Matrix
Highway
Major Road
Local Road
County Boundary
State Boundary

Data Sources:
USGS Topo Quads
ESRI Streetmap 9.3

N

0 5 10 15
Miles

L O C A T I O N   M A P



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11.0 APPENDIX

Whooping Crane sightings in the Project Area and 35-mile buffer area.

Obs. #	Adults	Juvenile	Date	Season	County	Location Description
Project Area						
None						
35-mile Buffer Area						
925	1	0	09/22/61	FALL	KIDDER	HORSEHEAD LAKE
926	1	0	09/24/61	FALL	OLIVER	FT. CLARK
937	2	1	10/25/64	FALL	BURLEIGH	10N MANDAN
942	2	0	04/13/67	SPRING	BURLEIGH	LONG LAKE NWR
944	2	0	04/27/67	SPRING	BURLEIGH	LONG LAKE NWR
945	2	1	04/16/68	SPRING	KIDDER	12N,8E WING
951	2	0	05/03/70	SPRING	BURLEIGH	3SW BISMARCK, MISSOURI RIVER
956	1	0	09/23/71	FALL	MCLEAN	1NE BLUE LAKE
960	1	0	10/16/71	FALL	MCLEAN	1E,2S TURTLE LAKE
962	1	0	10/19/71	FALL	KIDDER	
965	1	0	04/24/72	SPRING	BURLEIGH	MIDDLE RICE LAKE
968	1	0	09/27/72	FALL	BURLEIGH	LONG LAKE NWR
991	7	0	04/19/77	SPRING	BURLEIGH	10NE WING
997	1	0	10/21/77	FALL	BURLEIGH	3S,1.5E MENOKEN
998	1	0	10/28/77	FALL	BURLEIGH	22SW BISMARCK
1003	3	1	10/31/77	FALL	BURLEIGH	LONG LAKE NWR
1006	1	0	10/29/78	FALL	MCLEAN	LAKE WILLIAMS
1014	2	0	09/24/79	FALL	MCLEAN	2NE TURTLE LAKE
1023	1	0	09/29/81	FALL	MCLEAN	NEAR LAKE WILLIAMS
1034	3	0	10/14/82	FALL	KIDDER	6S LAKE WILLIAMS
1156	1	0	10/03/97	FALL	BURLEIGH	9N,2.25E STERLING I-94 EXIT
1161	1	0	10/09/97	FALL	KIDDER	2.5SE ROBINSON
1166	1	0	10/25/97	FALL	KIDDER	0.5S ROBINSON
1177	1	0	04/20/98	SPRING	BURLEIGH	4E MOFFIT, LONG LAKE NWR
1187	4	0	10/17/98	FALL	KIDDER	4S,4W ROBINSON
1188	2	0	10/16/98	FALL	EMMONS	5W BRADDOCK
1193	3	0	04/14/99	SPRING	BURLEIGH	2N,0.5E MOFFIT
1202	1	0	10/25/99	FALL	SHERIDAN	6N,2W GOODRICH
1204	2	1	10/27/99	FALL	MCLEAN	9W WASHBURY, NEAR MISSOURI R.
1206	1	0	10/26/99	FALL	KIDDER	5SW LAKE WILLIAMS
1207	1	0	10/03/99	FALL	SHERIDAN	6E,8S MCCLUSKY
1125	1	0	09/29/93	FALL	MCLEAN	2S,4.5E,.25N TURTLE LAKE
1126	1	0	10/13/93	FALL	MCLEAN	2N,3E TURTLE LAKE
1131	1	0	10/25/94	FALL	MCLEAN	1/2W TURTLE LAKE

Obs. #	Adults	Juvenile	Date	Season	County	Location Description
1146	1	0	10/13/96	FALL	BURLEIGH	3W,8N WING
1147	3	0	10/29/96	FALL	SHERIDAN	5N FLORENCE LAKE NWR
1148	4	0	10/01/96	FALL	BURLEIGH	3N STERLING
1149	1	0	10/03/96	FALL	BURLEIGH	5S,1E MCKENZIE
1043	4	1	11/07/83	FALL	BURLEIGH	LONG LAKE NWR
1044	1	0	10/13/83	FALL	MCLEAN	5W MERCER
1051	2	0	09/29/84	FALL	BURLEIGH	NEAR MCKENZIE SLOUGH
1056	2	0	09/18/84	FALL	WELLS	15SW HARVEY
1064	1	0	09/26/85	FALL	BURLEIGH	LONG LAKE NWR,5.5E,2N MOFFIT
1066	1	0	09/26/86	FALL	BURLEIGH	6N,1E WING
1067	1	0	09/21/86	FALL	BURLEIGH	NEAR LONG LAKE NWR
1069	4	0	04/17/87	SPRING	BURLEIGH	BISMARCK,MISSOURI RIVER
1072	4	1	04/15/88	SPRING	MCLEAN	3SE UNDERWOOD
1073	0	1	04/15/88	SPRING	MCLEAN	3SE UNDERWOOD
1080	1	0	05/04/89	SPRING	KIDDER	LONG LAKE NWR
1088	1	0	05/07/90	SPRING	BURLEIGH	2S,2E ARENA,LAKE ARENA WPA
1103	2	0	10/04/90	FALL	KIDDER	9S,2W STEELE
1104	1	0	10/04/90	FALL	KIDDER	3S,6W STEELE
1215	2	0	04/16/00	SPRING	EMMONS	8SW MOFFIT
1221	3	1	04/10/00	SPRING	BURLEIGH	8SE BISMARCK
1227	2	0	10/28/00	FALL	BURLEIGH	2N,2E MOFFIT
1231	1	0	09/20/00	FALL	KIDDER	7S,2W,0.5S STEELE
1234	8	1	11/03/00	FALL	OLIVER	10E CENTER
1246	4	0	10/22/01	FALL	BURLEIGH	15N,2E WING
1247	2	0	10/22/01	FALL	EMMONS	5S,12W MOFFIT
1248	2	1	10/23/01	FALL	EMMONS	5S,12W MOFFIT
1253	7	0	04/17/02	SPRING	BURLEIGH	0.25W MCKENZIE,MCKENZIE SLOUGH
1266	4	0	10/25/02	FALL	KIDDER	9S,1W STEELE
1267	5	0	10/25/02	FALL	BURLEIGH	BISMARCK, SERTOMA PARK
1269	2	0	10/25/02	FALL	EMMONS	5S,12W MOFFIT
1272	2	0	10/25/02	FALL	BURLEIGH	BISMARCK AIRPORT
1275	3	0	10/16/02	FALL	MCLEAN	2N WASHBURN
1277	6	0	10/16/02	FALL	MCLEAN	4.5NE WASHBURN
1279	3	0	04/13/03	SPRING	OLIVER	9SW WASHBURN
1280	3	0	04/13/03	SPRING	BURLEIGH	5N,3W DRISCOLL
1282	2	0	04/06/03/	SPRING	BURLEIGH	2W MENOKEN
1287	2	0	10/04/03	FALL	KIDDER	7S,4W STEELE
1291	2	0	10/16/03	FALL	BURLEIGH	LONG LAKE NWR,3E MOFFIT
1303	2	0	10/05/04	FALL	KIDDER	10SW STEELE

Obs. #	Adults	Juvenile	Date	Season	County	Location Description
1304	1	0	10/09/04	FALL	BURLEIGH	5NE MOFFIT
1308	1	0	10/10/04	FALL	KIDDER	12S STEELE
1321	2	0	04/30/05	SPRING	MORTON	5SW MANDAN
1324	1	0	09/30/05	FALL	BURLEIGH	LONG LAKE NWR, 3SE MOFFIT
1329	12	0	10/16/05	FALL	SHERIDAN	3S, 1.5W PICKARDVILLE
1334	2	1	11/03/05	FALL	BURLEIGH	4.5S, 1W DRISCOLL
1336	3	0	11/13/05	FALL	BURLEIGH	7W, 2S WILTON, MO RIVER BOTTOMS
1340	3	0	04/22/06	SPRING	MCLEAN	MISSOURI RIVER, 2W WASHBURN
1344	2	0	05/04/06	SPRING	BURLEIGH	9N, 2E WILTON
1345	1	0	05/05/06	SPRING	KIDDER	12N TUTTLE
1347	2	0	09/25/06	FALL	SHERIDAN	2W, 2S GOODRICH
1353	1	0	4/15/2007	SPRING	BURLEIGH	2E MENOKEN, ALONG HWY 10
1354	20	0	4/15/2007	SPRING	BURLEIGH	SW BISMARCK
1356	3	0	5/22/2007	SPRING	MERCER	4S, 7W WASHBURN
1908	2	0	10/22/2007	FALL	BURLEIGH	4S, 1.5E MCKENZIE
1946	4	1	11/03/2007	FALL	BURLEIGH	W-NW OF WING
TOTAL	**218**	**12**				

Source: USFWS data.

Tetra Tech personnel who prepared/reviewed this report:

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